

choice of engineering specialty and employer involves an assessment not only of the potential rewards but also of the risk of technological obsolescence.

Related Occupations

Engineers apply the principles of physical science and mathematics in their work. Other workers who use scientific and mathematical principles include engineering, natural science, and computer and information systems managers; physical and life scientists; mathematicians; computer systems analysts, engineers, and scientists; engineering and science technicians; and architects.

Sources of Additional Information

High school students interested in obtaining general information on a variety of engineering disciplines should contact the Junior Engineering Technical Society, by sending a self-addressed business-size envelope with six first-class stamps affixed to:

✍ JETS-Guidance, at 1420 King St., Suite 405, Alexandria, VA 22314-2794. Internet: <http://www.jets.org>

High school students interested in obtaining information on ABET-accredited engineering programs should contact:

✍ The Accreditation Board for Engineering and Technology, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012.

Internet: <http://www.abet.org>

College students interested in obtaining information on Professional Engineer licensure should contact:

✍ The National Society of Professional Engineers, 1420 King St., Alexandria, VA 22314-2794. Internet: <http://www.nspe.org>

Information on obtaining an engineering position with the Federal Government is available from the Office of Personnel Management through a telephone-based system. Consult your telephone directory under U.S. Government for a local number or call (912) 757-3000; TDD (912) 744-2299. That number is not toll free, and charges may result. Information is also available from the Internet site: <http://www.usajobs.opm.gov>

Non-high school students and those wanting more detailed information should contact societies representing the individual branches of engineering. Each can provide information about careers in the particular branch.

Aerospace Engineering

✍ Aerospace Industries Association, 1250 Eye St., NW., Washington, DC 20005. Internet: <http://www.aiaa-aerospace.org>

✍ American Institute of Aeronautics and Astronautics, Inc., Suite 500, 1801 Alexander Bell Dr., Reston, VA 20191-4344. Enclose \$2 to receive guidance materials and information.

Internet: <http://www.aiaa.org>

Chemical Engineering

✍ American Institute of Chemical Engineers, Three Park Ave., New York, NY 10016-5901. Internet: <http://www.aiche.org>

✍ American Chemical Society, Department of Career Services, 1155 16th St. NW., Washington, DC 20036. Internet: <http://www.acs.org>

Civil Engineering

✍ American Society of Civil Engineers, 1801 Alexander Bell Dr., Reston, VA 20191-4400. Internet: <http://www.asce.org>

Electrical and Electronics Engineering

✍ Institute of Electrical and Electronics Engineers—United States of America, 1828 L St. NW., Suite 1202, Washington, DC 20036. Internet: <http://www.ieee-usa.org>

Industrial Engineering

✍ Institute of Industrial Engineers, Inc., 25 Technology Park/Atlanta, Norcross, GA 30092. Internet: <http://www.iienet.org>

Materials Engineering

✍ The Minerals, Metals, & Materials Society, 184 Thorn Hill Rd., Warrendale, PA 15086. Internet: <http://www.tms.org>

✍ ASM International Foundation, Materials Park, OH 44073-0002. Internet: <http://www.asm-intl.org>

Mechanical Engineering

✍ The American Society of Mechanical Engineers, Three Park Ave., New York, NY 10016. Internet: <http://www.asme.org>

✍ American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle NE, Atlanta, GA 30329. Internet: <http://www.ashrae.org>

Mining Engineering

✍ The Society for Mining, Metallurgy, and Exploration, Inc., P.O. Box 625002, Littleton, CO 80162-5002. Internet: <http://www.smenet.org>

Nuclear Engineering

✍ American Nuclear Society, 555 North Kensington Ave., LaGrange Park, IL 60525. Internet: <http://www.ans.org>

Petroleum Engineering

✍ Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836. Internet: <http://www.spe.org>

Aerospace Engineers

(O*NET 22102)

Nature of the Work

Aerospace engineers are responsible for developing extraordinary machines, from airplanes that weigh over a half a million pounds to spacecraft that travel over 17,000 miles an hour. They design, develop, and test aircraft, spacecraft, and missiles and supervise manufacturing of these products. Aerospace engineers who work with aircraft are considered *aeronautical engineers*, and those working specifically with spacecraft are considered *astronautical engineers*.

Aerospace engineers develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas like structural design, guidance, navigation and control, instrumentation and communication, or production methods. They also may specialize in a particular type of aerospace product, such as commercial transports, military fighter jets, helicopters, spacecraft, or missiles and rockets. Aerospace engineers may be experts in aerodynamics, thermodynamics, celestial mechanics, propulsion, acoustics, or guidance and control systems.

Employment

Aerospace engineers held about 53,000 jobs in 1998. Almost one-half worked in the aircraft and parts and guided missile and space vehicle manufacturing industries. Federal Government agencies, primarily the Department of Defense and the National Aeronautics and Space Administration, provided about 1 out of 7 jobs. Business services, engineering and architectural services, research and testing services, and electrical and electronics manufacturing firms accounted for most of the remaining jobs.

California, Washington, Texas, and Florida—States with large aerospace manufacturers—employ the most aerospace engineers.

Job Outlook

Those seeking employment as aerospace engineers are likely to face keen competition because the supply of graduates is expected to exceed the number of job openings. Employment of aerospace engineers is expected to grow more slowly than the average for all occupations through 2008. The decline in Defense Department expenditures for military aircraft, missiles, and other aerospace systems has caused mergers and acquisitions among defense contractors. In addition,



An aerospace engineer tests avionics equipment.

Federal Government funding for research and development of new systems has also declined. Offsetting these declines, however, is the projected growth in the civilian sector due to orders from domestic and foreign airlines that need to accommodate increasing passenger traffic and to replace the present fleet of airliners with quieter and more fuel-efficient aircraft. Most job openings will result from the need to replace aerospace engineers who transfer to other occupations or leave the labor force.

Earnings

Median annual earnings of aerospace engineers were \$66,950 in 1998. The middle 50 percent earned between \$51,170 and \$82,620. The lowest 10 percent earned less than \$42,650 and the highest 10 percent earned more than \$93,880. Median annual earnings in the industries employing the largest numbers of aerospace engineers in 1997 were:

Aircraft and parts	\$72,200
Federal Government	70,000
Guided missiles, space vehicles, and parts	58,200

According to a 1999 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in aerospace engineering received starting offers averaging about \$40,700 a year; master's degree candidates, \$54,200; and Ph.D. candidates, \$64,400.

(See introduction to the section on engineers for information on working conditions, training requirements, and sources of additional information.)

Chemical Engineers

(O*NET 22114)

Nature of the Work

Chemical engineers apply the principles of chemistry and engineering to solve problems involving the production or use of chemicals. They design equipment and develop processes for large scale chemical manufacturing, plan and test methods of manufacturing the products and treating the by-products, and supervise production. Chemical engineers also work in a variety of manufacturing industries other than chemical manufacturing such as electronics, photographic equipment, and pulp and paper mills.

Because the knowledge and duties of chemical engineers cut across many fields, they apply principles of chemistry, physics, mathematics, and mechanical and electrical engineering. They frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in a particular area such as pollution control or the production of specific products such as automotive plastics or chlorine bleach. Chemical engineers are increasingly using computer technology to optimize all phases of research and production; therefore they need to understand how to apply computer skills to process analysis, automated control systems, and statistical quality control.

Employment

Chemical engineers held about 48,000 jobs in 1998. Manufacturing industries employed over 70 percent of all employees, primarily in the



Although many chemical engineers are employed by manufacturers, much of the job growth is expected to occur in services industries.